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Dated 7 January 2003

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1/77

19APR02 E748293 1 C04377
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Request for grant of a patent

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The Patent Office

Cardiff Road
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1. Your reference

FB05543

2. Patent application number
(The Patent Office will fill in this part)

0208917.5

19 APR 2002

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

James Thompson
18 Glenloughan Road
Kilkeel
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BT34 4SR
Northern Ireland

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation

7601511002

4. Title of the invention

Seating for a vehicle

5. Name of your agent *(if you have one)*

F.R. Kelly

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

9 University Street
BELFAST
BT7 1FY
Northern Ireland

Patents ADP number *(if you know it)*

7744417001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

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Continuation sheets of this form	0
Description	8
Claim(s)	0
Abstract	0
Drawing(s)	7 + 7

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Priority documents	0
Translations of priority documents	0
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	0
Request for preliminary examination and search *(Patents Form 9/77)*	0
Request for substantive examination *(Patents Form 10/77)*	0
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11. I/~~We~~ request the grant of a patent on the basis of this application.

Signature A Wallace Date

Alan Wallace, Representative 18/04/02

12. Name and daytime telephone number of person to contact in the United Kingdom Alan Wallace 028 9023 6000

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Seating for a vehicle

This invention relates to seating for a passenger conveyance. It has particular, but not exclusive, application to seating in a passenger carrying aircraft.

There are clear economic incentives that drive aircraft designers to provide as many seats as possible in a passenger aircraft. However, of late, concerns have been raised about potential health effects upon passengers who are forced to sit for an extended period in a seat that allows its occupant little room for movement. While this problem could be addressed by offering passengers more legroom, this would reduce the carrying capacity of the aircraft, and, in consequence, its revenue earning ability. At present, the extent to which reduced air pressure in an aircraft cabin contributes to observed health effects is not known. However, there is concern that corresponding effects might occur in similarly cramped seating in other circumstances, for example, in other form of transport such as aircraft, ships, hydrofoils, trains and coaches and so forth, as well as in other circumstances not related to transport.

Therefore, it is an aim of this invention to provide a seating arrangement that can be used in passenger aircraft and in other circumstances that can provide an occupant of the seats with additional space while having a minimal effect on seating capacity, as compared with conventional seating arrangements.

Therefore, from a first aspect, this invention provides a seating arrangement for a vehicle having seats arranged in a plurality of generally parallel ranks, each rank extending in a fore-and-aft direction for a person occupying the each seat, and in a plurality of rows, each row extending at an angle other than a right angle with respect to the ranks.

This arrangement, at its most general, can offer greater flexibility in arranging the seats in an optimal arrangement than can the conventional arrangement in which ranks and rows are at right angles to one another.

For example, the angle between the rows and the ranks may be at an angle of between 40° and 80°. More specifically, the angle may be between 50° and 70°, or approximately 60° to 62°.

Each seat most typically has a maximum fore-and-aft dimension and a maximum transverse dimension. In typical embodiments of the invention, the rows are spaced apart at a pitch distance than is less than the maximum transverse direction. This means, in effect, that adjacent seats in a row overlap one another in a transverse direction when viewed in a direction along the ranks. In such an embodiment, the armrest on one side of a seat may be foreshortened, whereby that foreshortened arm portion is located behind a forward and adjacent seat.

Preferably, the ranks are arranged in groups and at least some of the groups that are adjacent in a fore-and-aft direction are arranged such that their respective rows converge or diverge thereby defining a substantially triangular space between adjacent groups. More preferably, a walled compartment is provided in at least one space between adjacent groups. Further preferably, said compartment comprises a lavatory comprising a toilet located substantially at the apex of the compartment.

It has been found that the arrangement defined in the first aspect of the invention can be further enhanced by use of a seat of particular design, as will be discussed below. However, it should be noted that application of the arrangement of the first aspect of the invention is not restricted to use with such seats, and that the seats can be used in other arrangements.

From a second aspect, this invention provides a seat for use in a passenger conveyance, the seat having a back and a base, in which at least the back of the seat can be moved from a relatively upright position to a relatively reclined position, in which movement of the seat from the upright to the reclined position does not cause the back of the seat to move in a rearwards direction at a level below the armrest of the seat. This ensures that the seat back does not interfere with the arms of a seat immediately to the rear.

A seat embodying the invention is preferably constructed such that it has armrests that maintain a constant position with respect to a passenger in the seat as the seat moves between its upright and its reclined position.

A seat embodying this aspect of the invention may include a carrier for articles mounted on the rear of the seat back, and accessible to a person in a seat to the rear. The seat back may also carry a support for apparatus, such as a display monitor, that can be used by a person occupying the seat.

From a further aspect, this invention provides a passenger conveyance having seats arranged in accordance with the first aspect of the invention. The seats in such a passenger conveyance are most preferably each an embodiment of the second aspect of the invention.

Embodiments of the invention will now be described in detail, by way of example, and with reference to the accompanying drawings, in which:

Figure 1 is a seating layout plan of a passenger aircraft showing seats disposed in a conventional layout and in a layout embodying the invention;

Figure 2 is a side view of a group of ranks of seats in an aircraft arranged in accordance with the layout of Figure 1 which embodies the invention;

Figure 3 is a view from above of a group of ranks of seats in an aircraft arranged in accordance with the layout of Figure 1 which embodies the invention;

Figure 4 is an enlarged plan view of a group of seats arranged in accordance with the layout of Figure 1 which embodies the invention;

Figure 5 is a side view of a seat that is suitable for installation in the arrangement of Figure 1, illustrating the seat's reclining action;

Figure 6 is an alternative seating layout plan of a passenger aircraft showing seats disposed in an alternative layout embodying the invention; and

Figure 7 is an enlarged view of a portion of the seating layout plan of Figure 6.

Figure 1 shows seating layouts installed in a passenger aircraft. A typical seating arrangement of a Boeing 747 aircraft for economy class seats, as shown in the upper part of Figure 1, is designated 3:4:3, this indicating that the seats are arranged in groups of 3 ranks on the left of the aircraft, 4 ranks in the middle and 3 on the right, shown

respectively at 10, 12 and 14 in Figure 1. Each rank extends longitudinally of the aircraft, and within the ranks, the seats are arranged in rows that extend at a right angle to the ranks, across the aircraft.

In this seating arrangement, the seat base width w might typically be 457 mm. The aisle width a might be 406 mm and the pitch p might typically be 813 mm. The pitch is defined as the distance in a fore-and-aft direction between a specific point on one seat and the same specific point in the seat immediately in front or behind.

A seating arrangement embodying the invention is shown in the lower part of Figure 1, in this case, with a 3:5:3 arrangement at 20, 22 and 24 respectively. (Alternative arrangement embodying the invention might be arranged in a 4:4:4, a 3:5:3 or a 3:6:3 abreast configuration.) The embodiment comprises seats 30, each of which has a seat base width w' of 457 mm or 483 mm and an aisle width a' of 406 mm. The pitch p' in this embodiment is 914 mm. This is an increase over the conventional arrangement to ensure compliance with relevant regulations defining entry and exit access. However, given the increase in the number of seats across the aircraft, the total number of seats that can be installed in a given space on the aircraft is not substantially reduced, thereby ensuring that installation of seating of this embodiment does not reduce the capacity of the aircraft.

Comparing the conventional arrangement, and the arrangement embodying the invention as described above, the following can be concluded. First, the seat pitch has been increased. This distance is of critical importance in giving a perception of space from the point of view of the passenger. It is also possible to provide a passenger with additional room for a passenger's arms, giving each passenger armrests to which they one passenger alone has access. Second, from the point of view of the aircraft operator, it is possible to offer additional benefits to passengers without incurring reduced capacity (and therefore reduced revenue) in operating their aircraft. The passenger can be offered a greater seat pitch without or with minimum loss to capacity, or the operator can offer the passenger a wider seat while maintaining the same number of seats across the aircraft.

In this embodiment, the ranks of seats are each arranged on a respective axis that is generally parallel with the long axis of the aircraft (this is the fore-and-aft direction for a seated passenger). The rows of seats are arranged at an angle θ from the longitudinal axis, where $\theta \approx 62°$. Within each of the groups 20, 22, 24 of ranks, the rows are parallel to one another. It may also be the case that the rows of two or more groups are also parallel (as in the case of groups 22 and 24) or they may be at a similar angle but at opposite directions from the longitudinal axis (as in the case of groups 20 and 22).

Adjacent seats in each row overlap one another in a transverse direction. In Figure 4 there is shown a row that is angled to the right and to the rear of an aircraft. In such a row, each seat 30 has a right-hand armrest 32 that extends the full fore-and-aft length of the seat. Such an armrest 32 is essentially conventional in its configuration. On the left-hand side of the seat, an armrest 34 is provided that extends forward from the rear of the seat 30 to the rear of the seat immediately to the left and to the front. It will be seen that a passenger occupying the seat has exclusive access to each of the armrests 32, 34, neither armrest being shared with an occupier of adjacent seat 30. One particular advantage of this arrangement is that it allows the seat occupier to make adjustments to his own armrests 32, 34, and so optimise his own comfort, without bothering an adjacent passenger. In the preferred embodiment, therefore, one or both of the armrests 32, 34 of each seat 30 is mounted to the respective seat 30 by a conventional height adjustable mechanism such that the height of the, or each, armrest 32, 24 is height adjustable.

As may be seen from Figure 2, in the preferred embodiment the seat armrests comprise an elongate member projecting from the back of the respective seat, thereby defining a gap between the armrest and the respective seat base. As a result, a front part of the seat base of one seat may fit beneath the armrest of a forward and adjacent seat, as shown at 40 (Fig. 4). This enables a greater degree of overlap between the seats in a transverse direction, so increasing the seating capacity that can be provided in a given area (without compromising the effective size of the seat base). In an alternative embodiment, it is possible to form a cut away region at a front part of the seat base to fit against a rear part of an adjacent seat, although this narrows the seat base in this region.

A consequence of the arrangement of this embodiment is that the position of the armrests 32, 34 of any seat can be optimised for the occupant of that seat alone. It is not necessary to compromise the position of the armrest to accommodate the requirements of two people sharing the same armrest. However, it is also important that the back of one seat does not recline into the armrest of the seat behind.

With reference to Figure 5, each seat 30 comprises a seat base 50 and a seat back 52 supported on a frame 54. The seat has an upright position, shown at outline A in Figure 5 and a reclined position shown at outline B in Figure 5. As the seat moves between the upright and reclined positions, the back 52 pivots about an axis X which is at a height substantially the same height as the armrest of the seat immediately to the rear. The seat armrests 32, 34 are connected to the seat back 52 so that the armrests move as the seat is reclined thereby maintaining a constant position with respect to a person who is occupying the seat.

The seat back 52 may be provided with a pocket 60 facing to the rear of the seat. This pocket 60 can be used by an occupant of a seat to the rear as a receptacle for storing articles. Such a pocket is particularly advantageous when the seat is installed in accordance with an installation that embodies the first aspect of the invention, because the additional seat pitch provides space in which the pocket 60 can be located.

Also carried on the seat back 52 is an arm 66 that carries a monitor 68. The arm 66 can be pivoted about an approximately vertical axis to move the monitor from a stowed position in which it is to one side of the seat and a position for use (shown at 68A in Fig 3) in which the monitor is to forward of the occupant, within their line of sight. As can be seen in Fig 5, the monitor 68 moves as the seat is reclined to maintain a constant position with respect to the seat's occupant. This installation of the monitor takes advantage of the arrangement of seats described above because it occupies a space that might inconvenience a person in an adjacent seat.

The additional seat pitch offered by the arrangement of this embodiment permits an extensible footrest 70 to be mounted at the front of the seat base 50. The footrest can be pivoted between a stored position and an extended position, shown at 70A, for use. As

with the arm 66, the footrest 70 moves with the seat as it reclines, thereby ensuring that it maintains its position with respect to the seat's occupant.

Figure 6 shows an alternative seating layout plan, comprising a seating arrangement embodying one aspect of the invention. The seating layout plan of Figure 6 is illustrated in the context of a passenger aircraft, but is not limited to use with such. The seating arrangement of Figure 6 is shown, by way of example only, in a 3:6:3 arrangement, having 3 ranks of seats on the left side (as viewed in Figure 6), 6 ranks in the middle, and 3 ranks on the right side. The ranks are arranged in groups, indicated as 120, 121, 122, 123 on the left side, 124, 125 in the middle and 126, 127, 128, 129 on the right side of Figure 6. Within each group 120 - 129, the rows of seats are arranged in a diagonal, or oblique, manner (with respect to the longitudinal axis of the aircraft) substantially as described with reference to Figures 1 to 5. However, at least some of the groups that are adjacent in a longitudinal, or fore-and-aft, direction - for example groups 120 and 121, groups 124 and 125, and groups 128 and 129 - are arranged so that the respective rows of the adjacent groups are inclined in a substantially opposite direction with respect to the longitudinal axis of the aircraft. Hence, the respective rows in groups that are adjacent in a fore-and-aft direction diverge or converge with respect to the transverse axis of the aircraft. It is preferred that the rows of one group are arranged on an axis that is inclined from the longitudinal axis at an angle which is substantially complimentary to the angle at which the rows of the adjacent group are inclined. Hence, adjacent groups are effectively a mirror image of each other with respect to the transverse axis. The preferred acute angle with respect to the longitudinal axis is $\theta \approx 62°$, as described with respect to Figures 1-5.

It will be seen from Figure 6 that at the interface regions 130 between adjacent groups, the respective end row of each group together define a substantially triangular, or V-shaped, space, the advantages of which can be appreciated by considering Figure 7 which shows an enlarged view of the interface region 130 between adjacent seating groups 120, 121.

In Figure 7, the respective end rows 140, 141 of seating groups 120, 121 diverge with respect to the transverse axis of the aircraft in a direction towards an aisle 150, thereby defining a substantially triangular, or V-shaped space 130. A walled enclosure or

compartment 160 is provided in the space 130. The walled compartment 160 is substantially triangular, or V-shaped, in plan cross-section such that it substantially matches the shape and size of the space 130. Preferably the side walls 161, 162 of the compartment 160 are inclined at an angle $\theta \approx 62°$ with respect to the longitudinal axis, as shown in Figure 7. Conveniently, the compartment 160 is provided with a conventional double hinged door 168. The compartment 160 is particularly suited for use as a lavatory, or washroom, comprising a toilet 164 and normally a wash-basin 166. It is particularly preferred that the toilet 164 is located substantially at the apex of the compartment 160. This arrangement is considered to make efficient use of the space available - having the toilet 164 located at the apex of a substantially triangular compartment 160 reduces the amount of "wasted" space at either side of the toilet 164. A passenger (not shown) using the lavatory 160 benefits from the more efficient use of space as an impression is given of being in a relatively large compartment, even though the size of the compartment 160 may not, in fact, be greater than that of a conventional rectangular compartment (not shown) provided to fit the space 130.

In order to provide passengers (not shown) seated in rows facing a bulkhead with facilities otherwise provided by the seat in front, it is preferred to provide these facilities on the bulkhead itself. In the present embodiment, the rear of a seat provides a passenger in the seat behind with facilities in the form of a tray, stowage compartment and monitor, and may also provide facilities such as cup holders, telephones, coat hooks, and the like. Referring to Figure 6 by way of example, passengers seated in row 141 face a bulkhead in the form of compartment wall 162. It is preferred to provide respective facilities, such as a tray, a stowage compartment and a monitor (not illustrated in Figure 6), on the wall 162 in alignment with and facing the respective seat in row 141. It is further preferred, therefore, that the wall 162 is inclined, with respect to the longitudinal axis, at substantially the same angle as the row 141. It is also preferred that the spacing or pitch between the wall 162 and the seats in row 141 is substantially the same as the distance or pitch between seats in adjacent rows.

The invention is not limited to the embodiments described herein which may be modified or varied without departing from the scope of the invention.

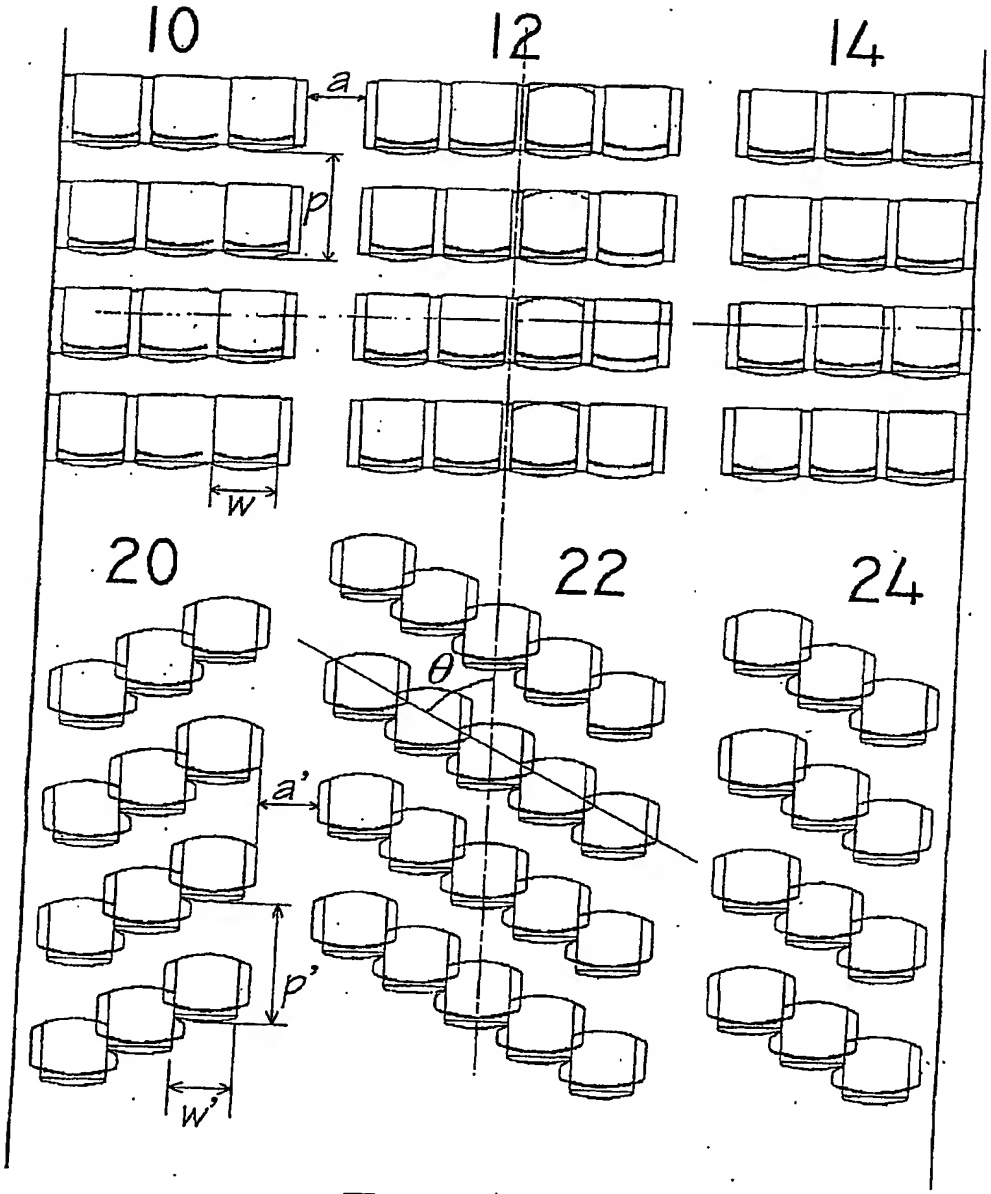

FIG 1

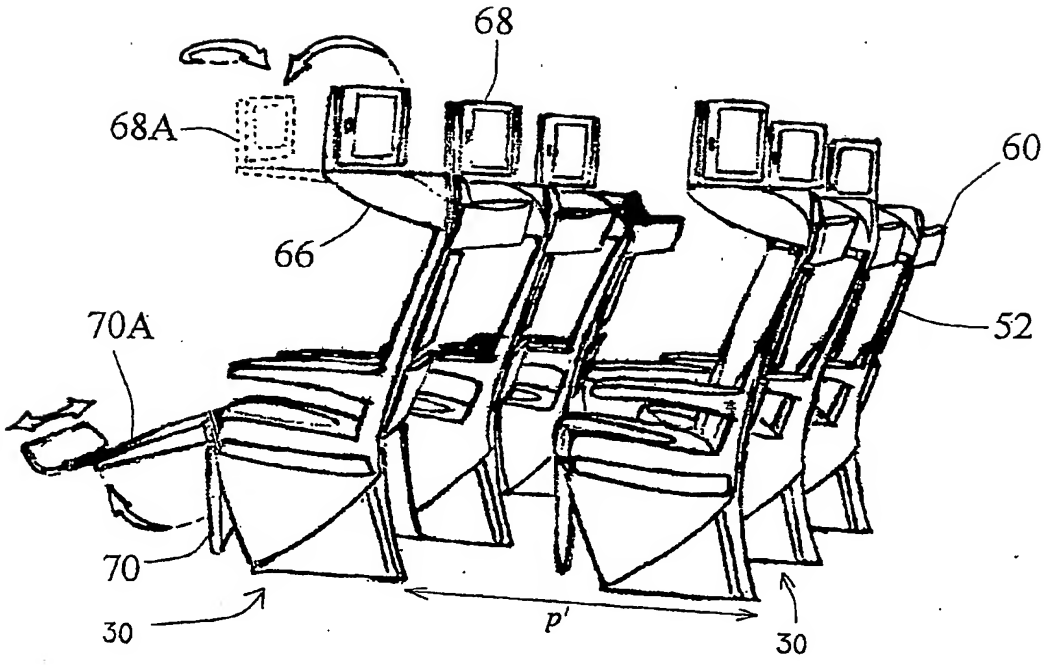

FIG 2

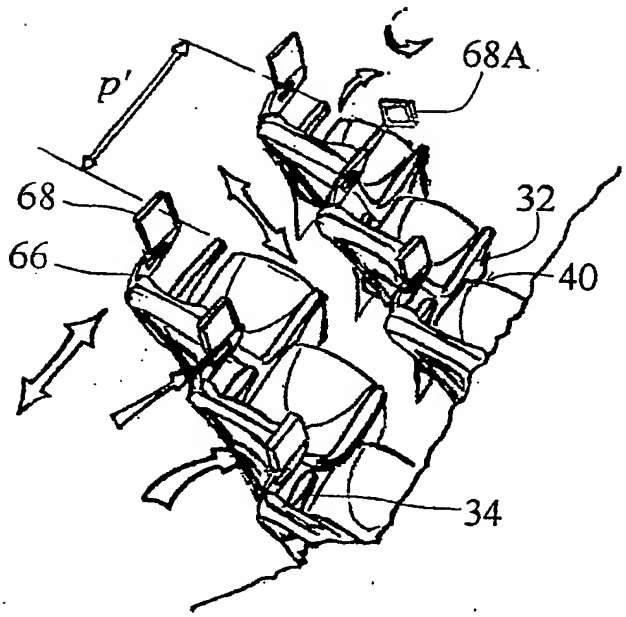

FIG 3

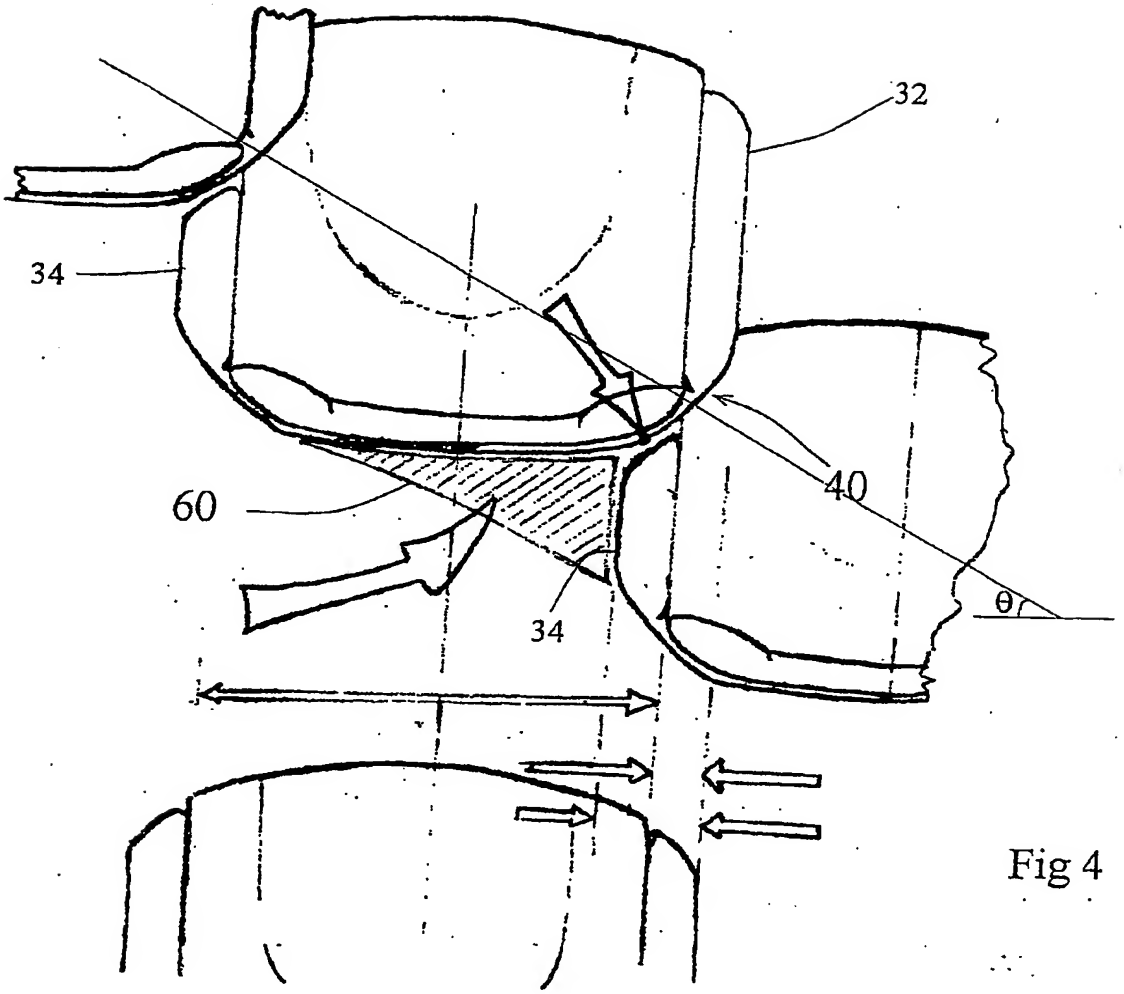

Fig 4

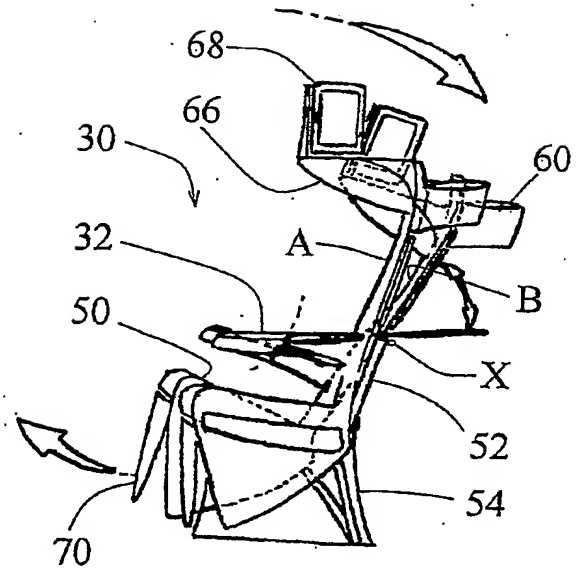

Fig 5

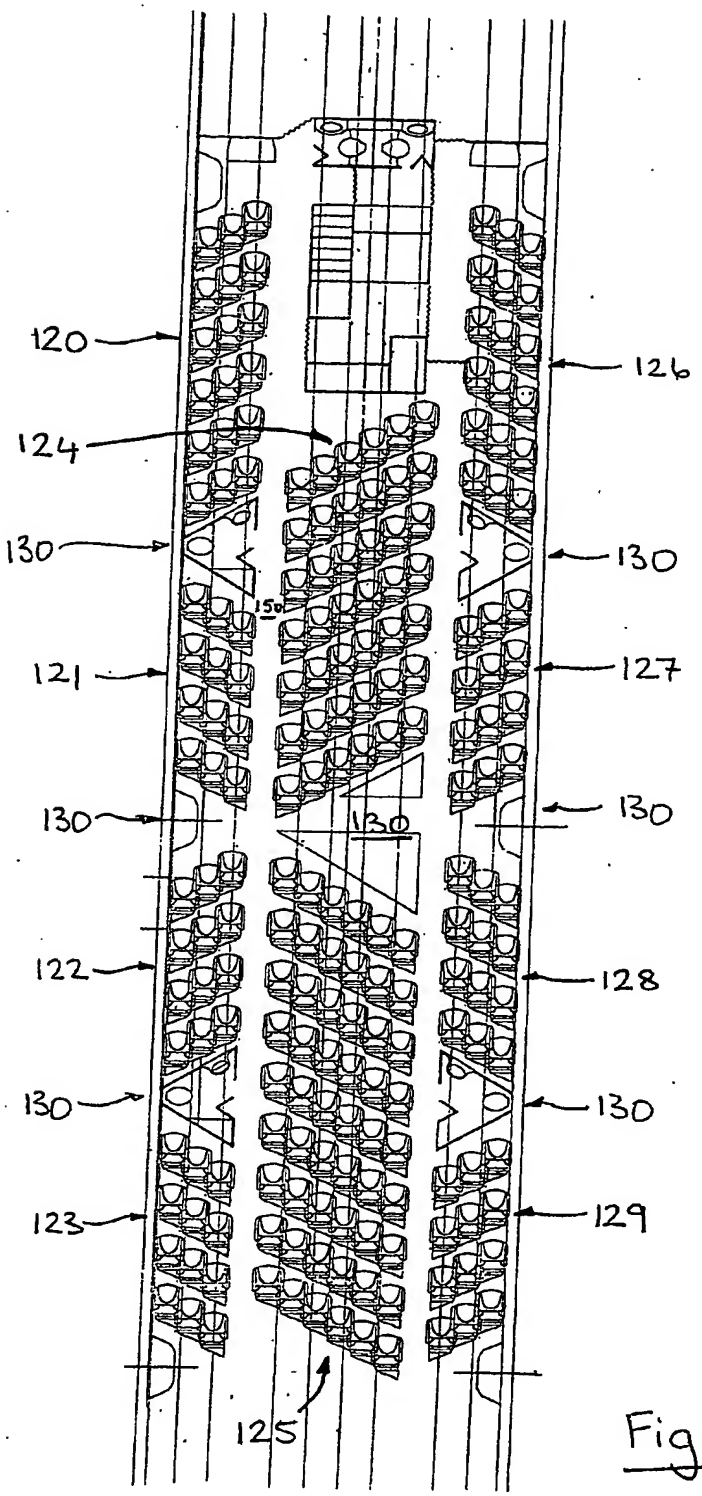
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Fig. 6

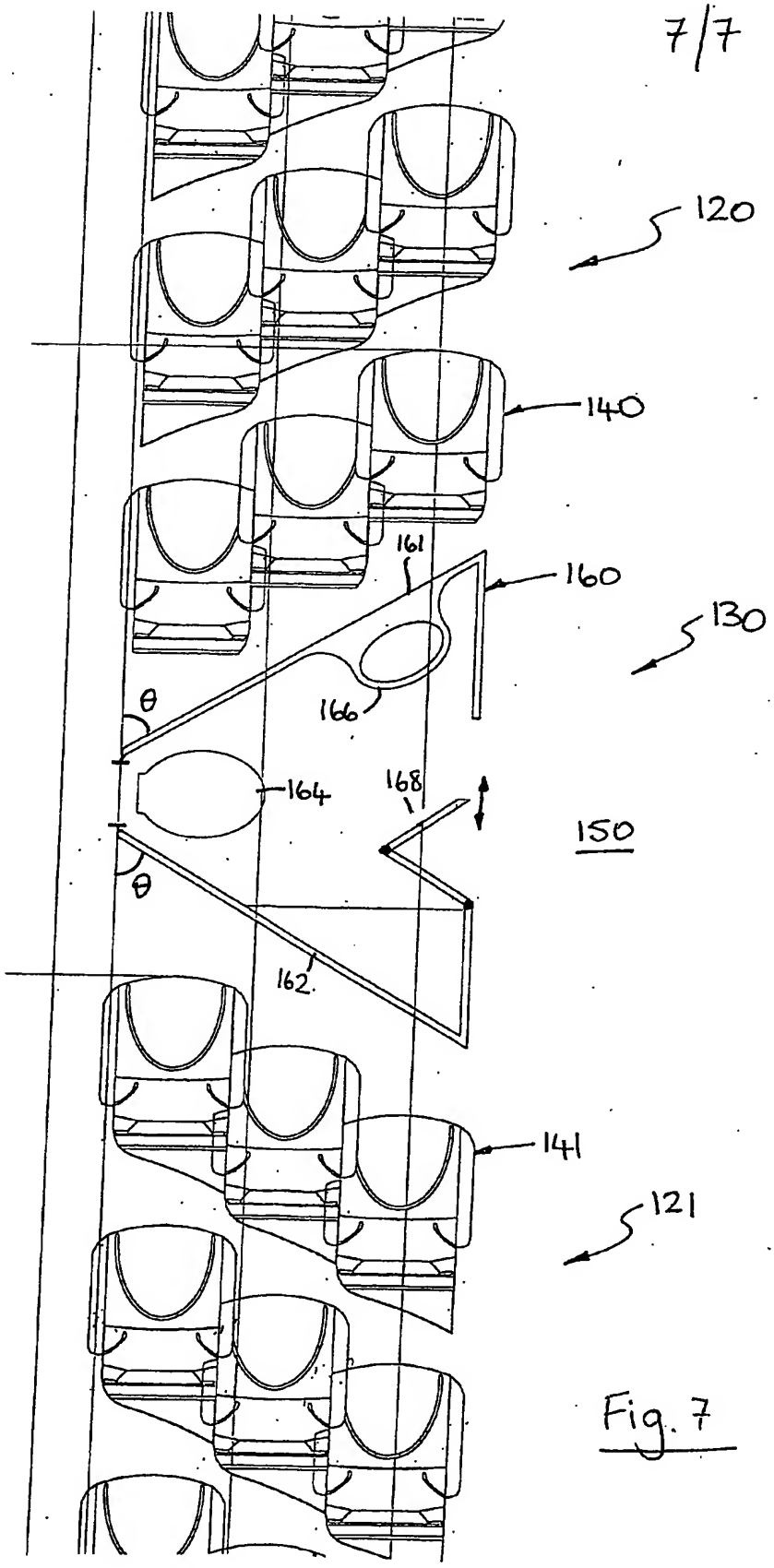

Fig. 7